AN INVESTIGATION INTO THE EPIDEMIOLOGY OF TUBERCULOSIS IN CHILDREN: WITH SPECIAL REFERENCE TO THE INCIDENCE AMONG CHILDREN KNOWN TO HAVE BEEN IN CONTACT WITH A TUBERCULOUS PERSON.

I, Reginald John Matthews, declare that the work in this thesis entitled "An Investigation into the Epidemiology of Tuberculosis in Children" was done and the thesis composed by myself.

signed,

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March 23rd, 1929.

AN INVESTIGATION INTO THE EPIDEMIOLOGY OF TUBERCULOSIS IN CHILDREN; WITH SPECIAL REFERENCE TO THE INCIDENCE AMONG CHILDREN KNOWN TO HAVE BEEN IN CONTACT WITH A TUBERCULOUS PERSON.

Introduction. During the forty-six years which have elapsed since Koch's classic discovery was announced many schemes have been inaugurated for the treatment, prevention and abolition of tuberculosis. For the past five years it has been the writer's privilege to be a junior member of the medical staff of one of them, the Welsh National Memorial Association, the Association which aims at attaining these objects for Wales.

While the methods originally adopted by the various units established in different parts of the world varied considerably, they were, on the whole, based on two great principles;-

(a) That of preventing the spread of infection.

(b) That of providing immunity for those afflicted.

That the schemes have been of great benefit to the public health is beyond dispute but their main objects are still far from attainment. Evidence indicates that, at the present time, at least ninety percent of the inhabitants of towns become infected before reaching middle life[1]; obviously there could not have been a much higher percentage infected before the discovery of the causal organism and the establishment of special branches of the medical service to deal with the disease. The second principle, that of providing immunity is still, many aver, the prerogative of Nature.

Recently the original principles have been under revision. Infection, we are now told, is necessary to the production of immunity[2], and methods have been adopted to ensure an active

immunity in children before they become exposed to the hazards of Nature.[3] However, each year in England and Wales between 30,000 and 40,000 deaths are attributed to tuberculosis, which figure, although much smaller than it used to be, is still very high for a disease which has been held to be preventable.

The death rate for tuberculosis is declining; moreover the rate of decline itself increases each year:[4] but a further acceleration of this rate is urgently needed. Can this object be achieved by an intensified application of present methods or are new ones required?

For some years the war cry of the anti-tuberculosis crusader has been "Earlier diagnosis" but amongst the adults referred to the tuberculosis dispensary for examination the early case is still conspicuous by it's absence. This is attributed partly to a natural reluctance on the part of the patient, who does not wish to know that his symptoms are due to tuberculosis, a reluctance which is not likely to be dispelled for many years, and partly (some would say chiefly) to the insidious nature of the onset of the disease. To cope with this insidiousness, this bar to early diagnosis, a reconsideration of the relationship between infection and disease is required.

It is conceded by most eminent authorities that each soul alighting on this earth invests a body which, at the moment of birth is free from tuberculosis. Yet one out of every ten is destined to be evicted from it's physical habitat by the disease, while eight others will acquire the infection. It is almost universally accepted that, while a predisposition may or may not be inherited, infection is acquired. Thus the life history of the average person may be divided into the following periods;-

(I) A period entirely free from tuberculous infection.

(2) A period (possibly momentary) of primary infection.

(3) An "Infected" period during which manifest disease may or may not develop.

At any time after the primary infection, re-infection may occur. Opie and others have shown that the re-action of a person to re-infection differs from his reaction to primary infection;[5] a study of immunity phenomena suggests that the difference may vary according to

(a) The size of each dose of infecting organisms, and

(b) The period which elapses between the doses.

The maximum reaction to re-infection does not occur immediately following, but some time after the primary dose.[6] From now on occurs the period during which re-infection is attended by it's characteristic reaction but possibly with a slowly diminishing intensity. It is during this period that the phenomenon of hypersensitiveness occurs, a state to which the term "Allergy" has been given.

In the study of other examples of hypersensitiveness it has been found that if the second dose of the particular substance is given before the development of reaction to re-infection a degree of immunity is produced. Is this true of tuberculosis?

The phenomenon is modified by a number of conditions such as measles, the onset of puberty, the last three months of pregnancy etcetera. What is the normal duration of allergy,and what is the relationship between further infection during this state, between infection during a period when this state has been modified by one of the above conditions, infection during a state of anergy and the onset of tuberculosis?

In town dwellers it is reasonable to assume that infection

is a risk to which most are exposed from their early years, yet an intensive examination of, say, children under IO years of age reveals a relatively low incidence of evident disease. During adolescence the incidence rises, albeit the diagnosis is only too often qualified by an indication that the disease is already beyond it's early stages.

Accordingly, about two years ago, the writer decided to trace the histories of a number of children who had previously been examined in the dispensary, especially those who had been in contact with people known to have had tuberculosis, through childhood to adolescence, the period during which it would appear the first acts in the drama of tuberculosis take place. The area included a large rural district and it was originally intended that the histories of children living in the remoter places in the rural part of the area should be similarly investigated and the results compared with those of the urban cases, but the rapidity with which the district has been opened up by the installation of bus services and other transport, and the consequent interference with epidemiological factors associated with rural districts, seemed likely to rob this part of the work of most of it's significance, so, about a year ago, it was abandoned and only the urban cases were considered.

OBJECTS OF THE INVESTIGATION.

The main objects of the investigation may conveniently be grouped under two headings;-

A. Points of practical importance to the Tuberculosis Dispensary worker.

(I) To obtain some information on the life histories, subsequent to examination, of those children who, at the time of the examination, are written off the register as "Non-tuberculous"

The writer desired especially to ascertain the incidence of tuberculosis, subsequent to examination, among those who had been in contact with a definite case of tuberculosis, to see if periodical re-examination of all contacts would be a profitable proceedure.

(2) To obtain information on the value of the von Pirquet reaction as an indication of infection and/or as an aid to diagnosis.

(3) To trace the course of disease, especially the more benign types such as tuberculosis of the cervical and mediastinal glands, and the end results both with and without treatment.

B. Objects concerning the Aetiology of Tuberculosis.

To obtain any information likely to help in explaining the aetiology of tuberculosis, with special reference to the problems mentioned on page 3.

METHOD.

The area in which the investigation was conducted is that known in the Welsh National Memorial Association as the Area of Newport and East Monmouthshire and consists, roughly, of that part of Monmouthshire which lies to the east of a line drawn from St Mellons in the south to Gilwern in the north. It includes the County borough of Newport and a mining district known as the Eastern Valley and, to satisfy the condition of an urban environ -ment, the cases were selected from these districts.

In order that a sufficient number of years should have elapsed since the original diagnosis was made, the case sheets of children (under I5 years of age at the time of the first examination) from the above districts,who had been examined in the years I9I7 to I920 were taken and the subsequent histories of as many as possible traced. Owing to a paucity of cases, a few others,

children who had been examined prior to 1917, were added later. The periods which had elapsed enabled one to trace some from infancy to childhood and others from childhood to adolescence, and also, to some extent, assisted one to evaluate the original diagnosis.

The cases were divided firstly into two main groups;-

A. Those who had been in contact with a known case of tuberculosis, henceforward designated "Contacts". Some of these had been examined simply because they were contacts while others had attended because they (or those responsible for them) were worried about their health. Contacts were further divided into three groups according to the nature of the infecting case and the intimacy of contact, thus;-

Group A1. Children who had been in intimate contact with a person suffering from definite tuberculosis (with pathological confirmation) presumably infectious.

Group A2. Children who had been in intimate contact with a person suffering from probable tuberculosis (strong clinical and/or Xray evidence but lacking patholog -ical confirmation), probably infectious.

Group A3. Contacts who could not be placed in either of the above groups.

B. Those who had had no known contact with the disease. henceforward referred to as "Non-contacts". These were children who had been referred for examination because they were suspected to be suffering from tuberculosis. As, in many of them, this suspicion was confirmed, it is obvious that the term " Non contact" does not mean that no contact had occurred but merely that none was known.

Both contacts and non-contacts were divided into sub/

/ into sub-groups for the consideration of sex and age factors.

The next step was to construct tables collecting together the information obtained from individual cases under the following headings;-

Von Pirquet results.

Incidence of tuberculosis in the various age groups

(a) At the original examinations

(b) Subsequently.

In those diagnosed as suffering from the disease, the nature of the lesions and their progress.

A consideration of the deaths.

Finally, in each section, any conclusions which could be drawn were noted and a summary compiled covering the whole inquiry.

Over five hundred case sheets of urban children were examined but it was necessary to reject a number of them; some because the information on the sheets was too indefinite to be of value and others because evidence indicated that they had suffered from tuberculosis before the year during which they were first examined, and, for reasons which will become evident later, it was desirable to include only those who appeared to have been free from evident tuberculosis up to the year during which the investigation of their histories commenced. Eventually, the histories of 453 children were investigated.

In almost all the von Pirquet reactions recorded on the case sheets, the tuberculins T and P.T. (supplied by Messrs Burroughs and Wellcome & Co) had been used, and the same were employed for those tests made during the investigation. A few children were tested with a tuberculin prepared by Obrien on a medium devised by Douglas but no difference in the nature of the reactions in these cases was observed and the results were not recorded

/ recorded separately. Except in a few instances both T and P.T. were used simultaneously. In 4 cases the reactions were positive to T only and in but II were they positive to P.T. only. As these I5 are dealt with separately in the beginning of the section dealing with von Pirquet results further differentiation between T and P.T was considered unnecessary and the other results are stated as simply "Positive"or "Negative". In 48 children the test was repeated, the intervals between the tests averaging a little over 2 years. While most of these had only one repetition, some had as many as five, the total number of results in these 48 children being II7. Counting only once those in which repetition produced no change of result, a sum total of 379 von Pirquet results were collected.

A diagnosis of tuberculosis made without pathological confirmation is always open to question. In these records, the figure I placed after the diagnosis indicates that the diagnosis was confirmed by either;-

(a) The finding of the tubercle bacilli, or

(b) Direct evidence obtained at an operation or by post mortem examination.

The figure 2 similarly placed indicates that no such confirmation was obtained. It should be understood however, that no case with a very doubtful diagnosis was included in the series.

An endeavour was made to trace the children to either death or their ages at the completion of the investigation (I928). 68 children were lost trace of and were therefore discounted from the tables of incidence and death although they showed no evidence of disease when last seen. Tables had to be constructed to show the incidence of disease and death among the remainder. It is obviously a difficult matter to adjust these groups in

/groups in such a manner that the incidences are comparable, for, at the time of the initial examinations the age compositions are not uniform. However, it so happens that none of the children here considered gave a history of tuberculosis having occurred at an age earlier than that at which they were first examined; furthermore their histories subsequent to examination were traced. It was therefore decided to take the total in each group as a common denominator for the age sub-groups in that group and so construct a "Life table" for that group, up to the 22nd birthday. Thus one obtained the incidence of tuberculosis in a group of "x" children during the first 22 years of life. Now the effect of examining more children at any one age would result in the increment not only of the numerator but also of the denominator for the group and the resultant fraction would bear to the original fraction a relation which would depend on the original fraction's constancy for that age. Can the original fractions be considered constants ? Or, in other words, would the effect of examining more children be to discover more cases of tuberculosis in the same proportion as in those already examined?

The writer's experience of routine examination of contacts leads him to believe that, in the case of contacts, it would. Therefore, if life tables for a common number (say 100) are calculated for different groups of contacts, these tables should, in the writer's opinion, be comparable; and should, moreover, in a complete investigation, have an absolute value as an indication of the incidence rate for any given number of a given class or sex of contact, within the limits of statistical error.

However, this is not true for non-contacts. Under this title occur

(a) Anumber of cases of tuberculosis - and therefore contacts themselves (possibly cases which escaped examination as

/escaped examination as such at an earlier age; and

(b) A number of people from the general population who may or may not be contacts.

Practically, if the total number of cases notified be taken as a standard, the number of cases in (a) is the compliment of the number diagnosed amongst contacts. One would expect that an examination of more members of that portion of the general public which remains after the known contacts have been excluded would reveal cases of evident tuberculosis in numbers whose rate of increase would vary inversely with the numbers examined, without however, any alteration in the relative age incidence. The life tables for non-contacts are not considered absolute and are not comparable with those for contacts except relatively for age incidence.

In constructing these life-tables it was first necessary to exclude all those whose histories could not be traced up to I928. Of the remainder, those still living had by I928 reached ages ranging from 7 to 29 years (see tables) The incidence of disease in those who had completed their 22nd years was now calculated. A further figure was desirable, namely the number of cases of tuberculosis likely to occur among those who, in I928, had not reached that age. An attempt to obtain this figure was made by estimating the incidence of tuberculosis at a given age,for those who had not yet reached that age, from the known incidence among those of the same group who had reached that age. For obvious reasons, the two sets of figures are shown separately.

It is not to be denied that an investigation of this kind is open to many sources of error, some of which cannot be eliminated; but it was the writer's hope that, where positive information might not be forthcoming, some indication might be obtained of the lines on which further research in the subject should be conducted.

AGE GROUPS: [YEARS]	0-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21-22
EXAMINED FOR FIRST TIME AT THIS AGE – DIAGNOSED "TB"	1	5	3	8	4	10	8	7	9	9	9	13	12	14	15							
" " " " " " " – " "NAT"	6	14	8	9	17	20	35	29	29	29	26	36	32	22	14							
PREVIOUSLY DIAGNOSED "TB"		1	6	9	17	21	31	39	46	58	69	80	94	107	122	137	141	142	142	144	145	145.
" "NAT." ⓐ TRACED & STILL "NAT" at THIS AGE		5	16	23	32	47	62	92	106	129	146	160	131	196	205	190	172	149	124	100	77	58
ⓑ STILL "NAT" BUT NOT ATTAINED THIS AGE.									1	1	8	12	23	31	37	53	69	90	112	133	154	172
ⓒ TRACED & NOW FOUND TO BE "TB"									3	2	2	1	1	1	–	4	1	–	2	1	–	–
ⓓ DEAD of CAUSES OTHER THAN TUBERCULOSIS.		1	1	1	1	1	1	1	2	2	2	2	2	3	3	6	6	6	7	8	9	10
ⓔ LOST TRACE OF. BY THIS AGE			3	4	4	6	11	16	26	30	33	40	43	50	57	63	64	66	66	67	68	68
NOT YET EXAMINED BUT PRESUMABLY "NAT.	446	427	416	399	378	348	305	269	231	193	158	109	65	29.								
TOTAL:	453.	453.	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453	453
Nos of ⓑ ESTIMATED LIKELY TO BECOME "TB" BY THIS AGE:											0·1	0·3	0·5	0·6	0·6	2·3	2·7	2·7	5·1	6·8	6·8	6·8.

"TB" = Diagnosed as suffering from active Tuberculosis.
"NAT" = No evidence of active Tuberculosis.

TABLE 1.

AGE DISTRIBUTION OF THE 453 CHILDREN IN RELATION TO THE FINDINGS AT EACH YEAR:

AGE GROUPS [YEARS]	0-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
AGE DISTRIBN of POSITIVE V.P. RESULTS in "TB" CASES	1	1	1	2	2	9	5	3	4	7	8	7	7	6	5	68
" " " " " " "NAT" "					4	6	3	3	5	5	5	6	5	8	3	53
" " " NEGATIVE " " "TB" "		1	1	2				1	2			1				8
" " " " " " "NAT" "	4	9	5	4	6	9	26	22	19	26	13	27	20	13	11	214
" " " DOUBTFUL " " "TB" "								1					1		1	3
" " " " " " "NAT" "		2		2	3	2	5	2		1	5	2	8	1		33
TOTALS:	5	13	7	10	15	26	39	32	30	39	31	43	41	28	20	379

TABLE 2.

AGE DISTRIBUTION OF THE "VON PIRQUET" RESULTS.

AGE GROUPS. [YEARS]		0-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21-22
MALES	EXAMINED FOR FIRST TIME AT THIS AGE. – "T.B."			1			1	1		3		1		3		1							
	" " " " " " " " – "NAT"	1	4	2	3	3	3	11	8	6	2	2	7	7	5	3							
	PREVIOUSLY DIAGNOSED "TB"				1	1	1	2	3	3	6	6	8	8	11	11	12	13	13	13	15	15	15
	" "NAT" (a) TRACED AND STILL "NAT" AT THIS AGE.			4	6	9	11	14	22	26	31	31	30	32	34	37	31	28	24	21	16	14	11
	(b) NOT YET ATTAINED THIS AGE.											1	3	8	12	14	19	22	25	26	31	33	35
	(c) TRACED AND NOW FOUND "TB"											1	–	–	–	–	1	–	–	2	–	–	–
	(d) DEAD of CAUSES OTHER THAN TUBERCULOSIS		1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	4
	(e) LOST TRACE OF BY THIS AGE.						1	1	4	8	9	9	10	10	11	11	12	12	13	13	13	13	13
	NOT YET EXAMINED BUT PRESUMABLY "NAT"	77	73	70	67	64	60	48	40	31	29	26	19	9	4								
	TOTAL.	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78
	Nº of (G) ESTIMATED LIKELY TO BECOME "TB" BY THIS AGE.																0·9	0·9	0·9	3·3	3·3	3·3	3·3
FEMALES	EXAMINED FOR FIRST TIME AT THIS AGE – "TB"	1	3	1	2	2		2			2	1	3	3	4	2							
	" " " " " " " " – "NAT"	3	5	3	3	3	6	3	4	3	8	7	14	7	1	2							
	PREVIOUSLY DIAGNOSED "TB"		1	4	5	7	9	9	11	11	12	15	16	20	24	29	31	32	32	32	32	32	32
	" NAT (a) TRACED AND STILL "NAT" AT THIS AGE.		3	8	11	14	17	21	24	27	29	32	34	43	45	43	41	38	33	26	23	16	14
	(b) TRACED BUT NOT YET ATTAINED THIS AGE.											4	6	9	10	12	15	18	23	30	32	39	41
	(c) TRACED AND NOW FOUND "TB"									1	1	–	1	1	1	–	1	–	–	–	–	–	–
	(d) DEAD of CAUSES OTHER THAN TUBERCULOSIS.																						
	(e) LOST TRACE OF BY THIS AGE.							2	2	2	2	3	5	6	9	10	10	10	10	10	11	11	11
	NOT YET EXAMINED BUT PRESUMABLY "NAT"	94	86	82	77	72	66	61	57	54	44	36	19	9	4								
	TOTAL.	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98
	Nº of (G) ESTIMATED LIKELY TO BECOME "TB" BY THIS AGE.												0·2	0·4	0·5	0·5	1·1	1·1	1·1	1·1	1·1	1·1	1·1

TABLE 3.

AGE DISTRIBUTION OF THE 176 CONTACTS IN RELATION TO THE FINDINGS AT EACH YEAR.

	AGE GROUPS (YEARS)	0-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21-22
MALES	EXAMINED FOR FIRST TIME AT THIS AGE – "TB"		1	1	3	1	4	3	1	1	6	3	4	4	3	2							
	" " " " " " " "NAT"	2	2	1	2	6	3	10	4	10	14	10	9	12	10	4							
	PREVIOUSLY DIAGNOSED "TB"			1	2	5	6	10	13	14	16	22	26	30	34	37	39	40	41	41	41	41	41
	" "NAT" (a) TRACED AND STILL "NAT" AT THIS AGE		2	3	4	6	12	15	23	23	30	40	48	55	63	68	62	56	49	47	36	27	20
	(b) " BUT NOT YET ATTAINED THIS AGE									1	1	3	3	4	5	6	11	16	23	25	36	45	52
	(c) " AND NOW FOUND "TB"									1		1					1	1					
	(d) DEAD, OF CAUSES OTHER THAN TUBERCUL^{S}														1	1	2	2	2	2	2	2	2
	(e) LOST TRACE OF BY THIS AGE			1	1	1	1	1	3	5	8	9	11	12	14	18	21	21	21	21	21	21	21
	NOT YET EXAMINED BUT PRESUMABLY "NAT"	134	131	129	124	117	110	97	92	81	61	48	35	19	6								
	TOTAL.	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136
	N° OF (b) ESTIMATED LIKELY TO BECOME "TB" BY THIS AGE											0·1	0·1	0·1	0·1	0·1	0·2	0·6	0·6	0·6	0·6	0·6	0·6
FEMALES	EXAMINED FOR FIRST TIME AT THIS AGE – "TB"		1	-	3	1	5	2	6	5	1	4	6	2	7	10							
	" " " " " " " "NAT"		3	2	1	5	8	11	13	10	5	7	6	6	6	5							
	PREVIOUSLY DIAGNOSED "TB"			1	1	4	5	10	12	18	24	26	30	36	38	45	55	56	56	56	56	57	57
	" 'NAT' (a) TRACED AND STILL "NAT" AT THIS AGE			1	2	3	7	12	23	30	39	43	48	51	54	57	56	50	43	30	25	20	13
	(b) " BUT NOT YET ATTAINED THIS AGE													2	4	5	8	13	19	31	34	37	44
	(c) " AND NOW FOUND "TB"									1	1						1				1		
	(d) DEAD, OF CAUSES OTHER THAN TUBERC^{S}									1	1	1	1	1	1	1	1	1	1	2	3	4	4
	(e) LOST TRACE OF BY THIS AGE.			2	3	3	4	7	7	11	11	12	14	15	16	18	20	21	22	22	22	23	23
	NOT YET EXAMINED BUT PRESUMABLY "NAT"	141	137	135	131	125	112	99	80	65	59	48	36	28	15								
	TOTAL.	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
	N° OF (b) ESTIMATED LIKELY TO BECOME "TB" BY THIS AGE																0·1	0·1	0·1	0·1	1·8	1·8	1·8.

TABLE 4.

AGE DISTRIBUTION OF THE 277 NON-CONTACTS IN RELATION TO THE FINDINGS AT EACH YEAR.

CONTACTS,- GROUP AI,- MALES.

The series contained sixteen boys who had been in intimate contact with persons suffering from definite tuberculosis.

Von Pirquet Results.	0-I	I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4-I5
Age distr; of Pos; reacts; "TB"							I								
.. .. "NAT"					I	I							I	I	
.. .. .. Neg; .. "NAT"			I	I					I			2	I	2	
.. .. ..Doubtful . "NAT"					I		I						I		

All the above have passed their ICth birthday and two-thirds their fifteenth. One child, aged 6 years, giving a positive reaction was diagnosed as suffering from pulmonary tuberculosis at the time. Another, VP negative at thirteen, developed pulmonary tuberculosis at the age of I8 years. No disease has yet been found in any of the others tested.

All the members of this group with no evidence of tuberculosis have been traced to their present age. There have been no deaths from causes other than tuberculosis.

Incidence of Tuberculosis. Up to the present the following four cases have been diagnosed as suffering from the disease.

Age	Diagnosis	VP & Age	Treatment	Fate.
6	P.T. 2	Pos 6	G.S.	Cured.
I5	P.T. I	None	G.S.	Now very ill.
I8	P.T. 2	None	G.S.	Died (haemoptysis)
I8	P.T.	Neg I3	G.S.	Condition stationary.

P.T. stands for Pulmonary Tuberculosis.
G.S. .. .. General Supervision at Dispensary.
The figure after the diagnosis indicates the type (see page 8)

CONTACTS,- GROUP AI,- FEMALES.

Twenty-two of the girls examined fall into this group. All of these were traced to death or their tenth birthdays and three-quarters of them to their fifteenth. One child was "Lost trace of" at the age of eleven. No deaths occurred, from causes other than tuberculosis, amongst those reported "NAT".

Von Pirquet Results.	C-I	I	2	3	4	5	6	7	8	9	IO	II	I2	I3	I4-I5
Age distr; of Pos; reacts; "TB"			I	I						I					2
.. .. "NAT"					2		I	I		I	I	2			
.. .. .. Neg; .. "TB"		I							I						
.. .. "NAT"		2						2							
.. .. ..Doubtful.. "NAT"				I			I	I							

One of the above, giving a positive reaction at I4, was reported "NAT" at the time but was diagnosed as suffering from pulmonary tuberculosis at the age of I5. Two cases are shown above as having given negative reactions although disease was evident. Both of these died, one in a few weeks and the other within a year. No disease has yet been found in any of the others tested.

Incidence of Tuberculosis. Up to the present the following nine cases have been diagnosed as suffering from tuberculosis.

Age	Diagnosis	VP & Age	Treatment	Fate.
I	Peritonitis 2	Neg I	G.S.	Died, Tuberc; Mening; few wks.
2	Spinal caries 2	Pos 2	Ceased Attending.	Died, Diphtheria at age IO.
3	Tuberculous 2 Mediast; glds	Pos 3	Hospital.	Left area age I2. Then well.
8	P.T. I	Neg 8	G.S.	Died, aged 9.
9	Tuberculous 2 Mediast; glds	Pos 9	G.S.	Developed P.T.(2) at age I9. Disease now quiescent.
II	P.T. and Tub; Cervic glds; 2	None	G.S.	Died, age I5.
I3	P.T. I	None	G.S.	Died within a year.
I4	P.T. I	Pos I4	G.S.	Died age I7.
I5	P.T. 2	Pos I4	G.S.	Disease Arrested.

Note; The terms "Cured", "Arrested", etc; are used in accordance with the definitions accepted by the Ministry of Health.

CONTACTS,- GROUP A2,- MALES.

There were examined thirty-seven boys who had been in contact (intimate) with persons suffering from diseases, diagnosed on strong clinical or Xray evidence as Tuberculosis, but which lacked pathological confirmation. (see page 6). Eighty-three percent were traced to their tenth birthdays and seventy-three percent to their fifteenth. One died at the age of fifteen from causes other than tuberculosis. Eight others, showing no /

/no evidence of tuberculosis when last seen were "Lost trace of" before attaining their fifteenth years of age.

Von Pirquet Results.	0-I	I	2	3	4	5	6	7	8	9	IO	II	I2	I3	I4-I5
Age distr; of Pos reactions "TB"						I					I				
.. .. "NAT"					I	I	2	2	I	2		2	2	I	I
.. .. .. Neg .. "NAT"					I		4	4	3	2	I	I	2		
.. .. ..Doubtful . "NAT"								I		I			2		
.. .. .. Neg . "TB"															

Of the I7 positive reactions, only two, as shown, occurred in boys with evident disease at the time. One case, "NAT" with a negative reaction at six years of age was diagnosed as suffering from tuberculosis of the cervical glands at IO. No disease has yet been found in any of the others tested.

Incidence of Tuberculosis. Up to the present the following four cases have been diagnosed as suffering from tuberculosis.

Age	Diagnosis	VP & Age	Treatment	Fate.
5	Spinal Caries 2	Pos 5	Hospital	Disease arrested but develd Tuberc Cervic; glds at I3. Latter now quiscent.
IO	Tuberc; cervic & Mediastinal glands. 2	Pos IO	G.S.	Cured.
IO	Tuberculous Cervic glds 2	Neg 6	G.S.	Improved.
I2	P.T. 2	None	Home.	Died within a year.

CONTACTS,- GROUP A2,- GIRLS.

Thirty-nine girls fall into this group. Five of them could not be traced through the full period (i.e. to their present age); no deaths occurred from causes other than tuberculosis.

Von Pirquet Results.	0-I	I	2	3	4	5	6	7	8	9	IO	II	I2	I3	I4-I5
Age distr; of Pos reactions "TB"	I	I			I						I		I	I	
.. .. "NAT"						I					I	I			
.. .. .. Neg .. "TB"				I											
.. .. "NAT"			2				2	I	I	2		3	3	I	I
.. .. ..Doubtful .. "NAT"					2								I		

In addition to those with evidence of tuberculosis at the time of the test, one girl, diagnosed "NAT" but giving a positive reaction at the age of 5, developed tuberculous keratitis at 8. Another,

/Another, VP negative and "NAT" at I2 years, was diagnosed as having tuberculosis of the cervical glands at I3. No tuberculosis has yet been found in any of the others tested.

Incidence of Tuberculosis. The following I5 cases have, so far, been diagnosed as suffering from tuberculosis.

Age	Diagnosis	VP & Age	Treatment	Fate.
0-I	Tuberc; of hilum. 2	Pos 0-I	G.S.	Lost Trace Of.
I	Tuberc; Cervic; Glands. 2	None	G.S.	Died, Meningitis, within yr.
I	Tuberc; Cervic; & Medias; glds 2	Pos I	G.S.	Developed P.T. at age of 8; Disease now Quiescent.
3	P.T. 2	Neg 3	-	Died within the year.
4	Tuberc; Mediast -inal glands. 2	Pos 4	G.S.	Cured.
6	P.T. 2	Pos I0	G.S.	Developed tuberc peritonitis at I6, pleural effusion at I7 yrs age. Condit; station.
8	Tuberculous Keratitis. 2	Pos 5	G.S.	Disease Arrested.
I0	Tuberc; Cervic; Glands. 2	Pos I0	G.S.	Cured.
I2	do; 2	Pos I2	G.S.	Cured; then recurred age 22
I2	P.T. 2	None	G.S.	Cured.
I2	P.T. 2	None	G.S.	Died at age I6.
I3	P.T. I	None	G.S.	Died within a year.
I3	Tuberc; Cervic; Glands. 2	Neg I2	G.S.	Condition stationary.
I3	do; 2	Pos I3	G.S.	Cured.
I4	P.T. 2	None	-	Died within the year.

Note. The cause of death is tuberculosis unless otherwise mentioned.

CONTACTS,- GROUP A3,- MALES.

Twenty-five other male contacts were examined. Three died of causes other than tuberculosis without ever having shown evidence of the disease. Five others could not be traced through the full period desired.

Von Pirquet Results.	0-I	I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5
Age distrib of Pos reacts; "TB"									I				I			I
.. .. "NAT"														I		
.. .. .. Neg .. "TB"			I													
.. .. "NAT"	I	I		I		2	2	I			I	I	I			2
.. .. ..Doubtful. "NAT"							I					2				

No disease has yet been found in any of the others tested.

Incidence of Tuberculosis. The following seven cases have, so far, been diagnosed as suffering from tuberculosis.

Age	Diagnosis	VP & Age	Treatment.	Fate.
2	Tuberculous Peritonitis 2	Neg 2	G.S.	Disease Arrested.
8	Tuberculous Knee joint. 2	Pos 8	Hospital.	Cured.
8	Tuberc; Hip. 2	None	Hospital.	Died, Meningitis, aged II.
8	P.T. 2	None	G.S.	Cured.
I2	Tuberculous Peritonitis I	None	-	Died within a year.
I2	P.T. 2	Pos I2	Hospital	Cured.
I4	P.T. 2	Pos I4	G.S.	Cured.

CONTACTS,- GROUP A3,- FEMALES.

Thirty-seven other female contacts were examined. Five could not be traced through the whole of the desired period. One girl, diagnosed as suffering from tuberculous cervical glands, died of pneumonia at the age of I5. No other deaths occurred from causes other than tuberculosis.

Von Pirquet Results.	0-I	I	2	3	4	5	6	7	8	9	IO	II	I2	I3	I4-I5
Age distr; of Pos Reactions "TB"												2	I	I	
.. .. "NAT"						I									
.. .. .. Neg .. "NAT"	I	2			I	I		2	I	4	I	5	2	I	I
.. .. ..Doubtful . "NAT"		I				I					2				

One of those giving a doubtful reaction at IO was diagnosed as having a tuberculous elbow at I3. No tuberculosis has yet occurred in any of the others tested.

Incidence of Tuberculosis. Up to the present the following eight cases have been diagnosed as suffering from tuberculosis.

Age	Diagnosis	VP & Age	Treatment	Fate.
4	Tuberc; Hip. 2	None	Hospital	Cured.
6	Tuberc; Hip. 2	None	Hospital	Cured.
9	Tub;Cerv; Glds2	None IIO	G.S.	Disease Arrested.
II	Tuberc; Elbow 2	Doubtful	G.S.	Died, Meningitis, age I3.
II	Tub Cerv; Glds2	Pos II	G.S.	Cured.
II	Tub Medias gds2	Pos II	G.S.	Disease Quiescent.
I2	Tuberc ankle 2	Pos I2	G.S.	Condition stationary.
I3	Tub Cerv Glds 2	Pos I3	G.S.	Died, Pneumonia, aged I5.

NON-CONTACTS,- MALES.

One hundred and thirty-six boys who gave no history of having been in contact with any known cases of tuberculosis were examined. Twenty-one of those in whom no evidence of tuberculosis was found could not be traced through the full period desired. Two cases died from causes other than tuberculosis without ever having shown any signs of the disease.

Von Pirquet Results.		0-I	I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4-I5
Age distr; of Pos reactions	"TB"					I	3	2	I	I	4	4	2	3	I	
.. ..	"NAT"						I			I	I			I	2	2
.. .. .. Neg ..	"TB"												I			
.. ..	"NAT"	2	I	I	I	I	2	8	2	6	I2	7	9	6	4	2
.. .. ..Doubtful..	"TB"													I		
.. ..	"NAT"				I			2				I		4	I	

Of the thirty giving positive reactions, 22 were found to be suffering from tuberculosis at the time. One of these, aged I0, had previously given a negative reaction at 8 years of age. (This child died at the age of I5). Another case, with no evidence of tuberculosis and giving a negative reaction when examined during the first months of life, died of meningitis at the age of eight. Yet another, with no evidence of tuberculosis and giving a negative reaction at 6, developed P.T. at the age of I5 but still gave a negative reaction to tuberculin (this patient's condition is stationary at present; his sputum is positive). Of the 65 who gave negative reactions, only one was diagnosed as suffering from tuberculosis at the time. One of the doubtful reactors showed evidence of the disease. No disease has since been found in any of the others tested.

Incidence of Tuberculosis. Up to the present the following 4I cases in this group have been diagnosed as cases of tuberculosis.

Age	Diagnosis	VP result and Age.	Treatment	Fate
I	Dactylitis 2	None	G.S.	Lost Trace Of.
2	Spinal Caries 2	None	Hospital	Disease Arrested.
3	Tuberc Hip. 2	None	G.S.	Died, Generalised Tubercul-osis, aged I2.

(Non-contacts, Males, continued)

Age	Diagnosis	VP & Age	Treatment	Fate
3	Spinal Caries 2	None	-	Died within the year.
3	Tub Mediastinal Glands. 2	None	G.S.	Cured.
4	Tuberc; Hip I	Pos 4	Hospital	Died within a year.
5	Tuberc Cervical & Mediast gds 2	Pos 5	G.S.	Cured.
5	Tub Cervical Glands. 2	Pos 5	G.S.	Developed P.T. age I2. This now Quiescent.
5	do 2	None	G.S.	Cured.
5	Tuberc Hilum 2	Pos 5	G.S.	Lost Trace Of.
6	Tuberc Cervical Glands. I	Pos 6	Hospital	Cured.
6	Tuberculosis of Metatarsus 2	Pos 6	Hospital	Disease Quiescent.
6	Tuberc Cervical Glands 2	None	Hospital	Disease still active.
7	Tuberc Cervical Glands 2	Pos 7	G.S.	Disease Arrested
8	Tuberc Hilum 2	Pos 8	G.S.	Disease Arrested.
8	Meningitis. 2	Neg 0-I	-	Died within few weeks.
9	Tuberc Hilum 2	Pos 9	G.S.	Cured
9	Tuberc Cervical Glands 2	None	G.S.	Disease Arrested.
9	Pleural Effus 2	Pos 9	G.S.	Disease Arrested.
9	Tuberc Hilum & Pleurisy 2	Pos 9	G.S.	Cured
9	Cervical Gds 2	Pos 9	G.S.	Cured
9	do 2	None	Hospital	Disease Arrested.
I0	P.T. I	Neg at 8 pos ..I0	Hospital	Died aged I5.
I0	Tub Mediastinal Glands 2	Pos I0	G.S.	Disease Arrested.
I0	Pleurisy 2	Pos I0	G.S.	Cured.
I0	Cervical and Mediastinal gds 2	Pos I0	G.S.	Lost Trace Of.
II	Cervical glds 2	Neg II	Hospital	Cured.
II	do 2	Doubtful	G.S.	Cured.
II	do 2	Pos II	G.S.	Cured.
II	do 2	Pos II	G.S.	Cured.
II	Tuberc Knee 2	None II	Hospital	Died aged I3.
I2	Tuberc Hilum 2	Pos I2	G.S.	Disease Arrested.
I2	Tuberc Cervical Glands 2	Pos I2	G.S.	Cured.
I2	P.T. 2	Pos I2	-	Died aged I4.
I3	Tuberc Cervical Glands I	None	Hospital	Cured.
I3	Tuberc Ulcer of leg 2	Pos I3	Hospital	Cured.
I3	Pleural Effus 2	None	-	Lost Trace Of.
I4	Tuberc Foot 2	None	-	Died aged I6.
I4	Tuberc Hip 2	None	-	Died aged 22. (?Banti's Dis)
I5	P.T. I	Neg 6&I5	G.S.	Disease Active.
I6	Meningitis. 2	None	-	Died within few weeks.

NON-CONTACTS,- FEMALES.

One hundred and forty-one female non-contacts were examined. Of those in which no evidence of tuberculosis was found, 23 could not be traced through the full period desired. Four died from causes other than tuberculosis without ever having shown signs of the disease.

Von Pirquet Results		0-I	I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4-I5
Age distr; of Pos reacts,	"TB"				I		5	2	2	2	2	2	3	I	3	2
" " " " "	"NAT"						I			3	I	3	I	I	3	
" " " Neg "	"TB"				I				I	I						
" " " " "	"NAT"		3	I	I	3	4	I0	I0	7	6	3	6	5	5	5
" " "Doubtful.	"TB"								I							I
" " " " "	"NAT"		I				I					2				

One child, having given a negative reaction at the age of 3 yrs, gave a positive result at 8; another, having given a negative reaction at II, proved positive at I3: neither of these showed signs of disease at any time. One girl who failed to react to tuberculin at II, developed a pleural effusion at I9, and has since become TB plus. No disease has since been found in any of the others tested.

Incidence of Tuberculosis. Up to the present the following 57 cases have been diagnosed as suffering from tuberculosis.

Age	Diagnosis	VP & Age	Treatment	Fate.
I	Dactylitis 2	None	Hospital	Cured.
3	Tuberc; Cervic Glands I	None	Hospital active at	Lost trace of at 8. Disease that time.
3	Tuberculous Peritonitis 2	Neg 3	-	Died within the year.
4	Tuberc; Knee 2	None	Hospital	Disease Quiescent
3	Spinal Caries 2	Pos 3	Hospital	Disease Quiescent.
5	Cervical Glds I	Pos 5	Hospital	Cured.
5	P.T. 2	Pos 5	G.S.	Lost trace of.
5	Cervic; Glds 2	Pos 5	G.S.	Disease Arrested.
5	Cervical and Mediastin Glds 2	Pos 5	G.S.	Cured.
5	Tuberc; Hip 2	Pos 5	G.S.	Cured.
6	Tuberc; Hilum 2	Pos 6	G.S.	Devel; P.T. at I6; Active.
6	Dactylitis. 2	Pos 6	Hospital	Cured.
7	Tuberculous Peritonitis I	None	Hospital	Died within a year.
7	Pleural Effus 2	Neg 7	G.S.	Cured.
7	Tuberc Cervical & Mediast gds 2	Doubtful	G.S.	Cured.

(Non-contacts,- females, continued)

Age	Diagnosis		VP & Age		Treatment	Fate.
7	Tuberc hip	2	Pos	7	G.S.	Cured.
7	Lupus	2	Pos	7	G.S.	Disease still active.
7	Hilum	2	None		G.S.	Lost Trace Of
8	Pleural Effus	2	None		G.S.	Cured
8	P.T.	2	None		G.S.	Died Tub Periton within yr.
8	Tuberc Glands (Cervical)	2	Pos	8	G.S.	Disease still active.
8	Tuberc glands of axilla	2	Neg	8	G.S.	Pleural Effus at I6. Active
8	Tuberculous Peritonitis	2	Pos	8	G.S.	Died within two years.
8	P.T.	2	Neg	6	-	Died P.T. within the year.
9	Tuberc Mediast Glands.	2	Pos	9	G.S.	Disease Arrested.
9	P.T.	2	Pos	9	G.S.	Disease Arrested.
I0	Tuberculous Peritonitis	I	Pos	I0	Hospital	Disease Quiescent.
I0	Tuberc Shoulder		None		Hospital	Died of Epilepsy.
I0	Tuberc Hilum & Cervical Glds	2	Pos	I0	G.S.	Cured
I0	Tuberc Hip.	2	None		Hospital	Disease Quiescent.
II	Cervical Glds	I	None		Hospital	Cured.
II	do	2	Pos	II	G.S.	Lost Trace Of.
II	do	2	None		Hospital	Developed Pleurisy; Quiescent.
II	do	2	None		Hospital	Lost Trace Of.
II	Tuberc Mediast Glands.	2	Pos	II	G.S.	Lost Trace Of.
II	Tuberc of Cheek and ?P.T.?	2	Pos	II	G.S.	Died (TB plus) aged I7.
I2	Tuberc Mediast Glands.	2	Pos	I2	G.S.	Developed P.T. Now Quiescent
I2	Cervic Glands	2	None		G.S.	Cured.
I3	P.T.	I	None		G.S.	Died aged I5.
I3	Tuberc Cervical Glands	I	Pos	I3	Hospital	Disease Quiescent.
I3	do	2	None		G.S.	Died Meningitis within year.
I3	do	2	None		G.S.	Cured.
I3	Mediastin Gds	2	Pos	I3	G.S.	Disease Arrested.
I3	Cervical Glds	2	Pos	I3	G.S.	Died P.T.(TB plus) age I8.
I3	Spinal Caries	2	None		Hospital	Died aged I6
I4	P.T.	I	None		-	Died within a year.
I4	P.T.	I	None		-	Died Within a year.
I4	P.T.	I	None		-	Died Within a year.
I4	Tuberc Cervical Glands	2	None		-	Lost Trace Of.
I4	P.T.	2	None		-	Died within a year.
I4	Cervical gds	2	None		G.S.	Cured
I4	P.T.	2	Doubtful		G.S.	Died aged I5 years.
I4	Tuberc Knee.	2	Pos	I4	Hospital	Disease still Active.
I4	P.T.	2	None		G.S.	Died within a year.
I4	Cervical Glds	2	Pos	I4	Hospital	Disease still active.
I5	P.T.	2	Pos	8&I2	G.S.	Disease Quiescent
I6	Pleural Effus	2	Neg	II	G.S.	Dev P.T.(TB plus) aged 22. Disease still active.

THE VON PIRQUET RESULTS

As may be seen from the foregoing tables, 379 results were obtained of which 222 were negative, I2I positive and 36 were doubtful. This is exclusive of those repetitions in which the results were unchanged.

Four cases reacted to human tuberculin only, although tested with both human and bovine. These were;-

A girl contact (Group A2),	age 4;	Diagnosed	Tub Mediast Glds;(2)
A boy contact (Group A3),	aged I2;	..	P.T (2)
.. .. ..	.. 8	..	"NAT"
.. non-contact	.. 5	..	Tuberc; of Hilum.(2)

The last child was lost trace of shortly after the diagnosis was made. The others have all done well and show no evidence of active disease at present. It will be noted that in no case did the diagnosis receive pathological confirmation.

Eleven cases reacted to bovine tuberculin only, although tested with both varieties. These were;-

A girl contact (Group AI),	aged 4;	Diagnosed	"NAT".
.. .. ,	.. IO;	..	"NAT".
.. .. ,	.. II;	..	"NAT"
.. ..non-contact	.. 6;	..	Tub; Dactylitis (2)
.. .. ..	.. I2;	..	"NAT"
.. .. ..	.. I4;	..	Tuberc; Knee (2)
. girl contact (Group A2),	.. I;	..	Tuberc Cervical & Mediast Glds (2)
. Boy non-contact	.. 5;	..	"NAT"
.. .. ..	.. 6;	..	Tub Cervic Gds (I)
.. .. ..	.. II;	..	Tub Cervic Glds (2)
.. .. ..	.. I3;	..	"NAT"

The girl diagnosed as having a tuberculous knee is still suffering from active disease. The girl aged I year in the above table developed pulmonary tuberculosis at the age of eight but this is now quiescent. One child, the girl aged II, was "Lost trace of" shortly after the diagnosis was made. All the others are now well, no fresh disease having occurred since the above results were first recorded.

It is interesting to note that the three children with disease who reacted to human tuberculin only, were all suffering from pulmonary types; while the five who reacted to bovine only, were victims of non-pulmonary varieties, but, of course, the numbers are too small to allow any significance to be attached to this.

Doubtful von Pirquet Results. (see Table 2, page I2)

The most obvious point is that, out of the 36 children who gave doubtful reactions, only three were found to have evidence of active disease; they were;-

A boy non-contact, aged I2; Diagnosed Tuberc Cervical Glds (2)
. girl .. .. .. 7; .. .. Cervic & Mediast Gds (2)
. .. . I4; .. P.T. (2)

The last mentioned died aged I5. The others are both quite well. Doubtful reactions were commonest about the I2th year of age but comparison with the table showing the total number of reactions and their distribution relieves this of significance. They were slightly commoner in boys than in girls and in contacts than in non-contacts, although the three with disease were non-contacts.

Results in Repeated V.P. Tests.

Forty-eight children were subjected to repeated tests at intervals averaging a little over two years. (See Table 5, p 26). While most of them had only one repetition of the test, some had as many as 5. The results were, briefly;-

Negative-unchanged, in 44 cases aged I-I2 when first VP was done.
(.. .. .. 2I of these between 5 & 9 .. ..)
Positive-unchanged, .. 2 cases aged 8 & 9 when .. ..
Reaction, previously neg, became pos in 8 cases aged 2-I3 when first V.P. was done.
Reaction, previously pos, became neg in 3 cases 3,4 & 7 when first V.P. was done.
Reaction doubtfull in 8 cases of repetition.

At the time of the first test, no evidence of active tuberculosis was found in any of these children. Subsequently, tuberculosis developed in 5 of them, and 4 of these were of "Negative/

(Ocontind on p. 27)

Case No; Contacts.	Group;	Sex;	0-I	I	2	3	4	5	6	7	8	9	IO	II	I2	I3	I4	I5	Fate if over I5.
4320	AI	M			-			+			✱	+		+	NAT				
52I4	A2	M		-				-	-	-				NAT					
6940	AI	F		-					?				NAT						
4206	A2	M			-							-			NAT				
5229	A3	M			-							-			NAT				
4456	A3	F				-	-	+								NAT			
6088	A3	M			-	-							?	NAT					
5984	A2	M				-		-							NAT				
5I87	AI	F	-			✱	+						NAT						
57I4	A2	F					+		-					-	NAT				
4628	A2	F						-		-		-			-		Tub		Cervic Glds.
3947	A2	M							-	-	Lost	Trace	Of						
3884	A2	F							-	-									NAT age I6.
682I	AI	M									-					-			NAT age I6.
5588	A2	M										-	-	-					Died (NAT)
5269	A3	F												-		-			VP+ NAT @ I9
4074	A2	M												-	-	Lost	Trace	Of	
4703	A2	F												-	-				NAT age 2I.
5I67	A3	M												-		+			NAT age 2I
7402	AI	M													-	-			P.T. at I9.
Non-contacts.																			
6495		F								-		-							NAT age I5.
4654		F				-					+				NAT				
4672		M					-	-	-								NAT		
4586		F					-				-						NAT		
5365		M					-				-						NAT		
5I88		F					-	-	-	-	-					-	NAT		
43I8		F						+	-										NAT age I5
6257		F						-		-	Lost	Trace	Of						
5378		F							-										VP-PT @ I5
4790		F							-	-									NAT age I6
4422		F							-	?	-		?	Left	Area.				
42I0		F							-	-									NAT age I6
4896		M							-									+	NAT age I6
6I04		F							-	-									NAT age I6
4444		M								-			-			-			NAT age I7
4829		F								+	-		-						NAT age I7
48I6		F								-		-							NAT age I7
3964		F								-		-							NAT age I7
4677		F								-			-						NAT age I7
4706		F									+				+				NAT age I8
4645		M									-	-							NAT age I8
5207		M									-			IO-VP	+	P.T	(I)	Died	I5
4648		M										+				+Left	Area.		
4798		F											-	-					PT (I)✱@ 22
4802		F											-					-	Died (NAT) 20
6I74		M											-	-					NAT age I9
5082		F												-				- +	NAT age 20
4760		F													-				VP-@ I5. Lost Trace @ 20

None of the above showed any evidence of active tuberculosis when first tested. Those of which trace was lost showed no disease when last seen.

TABLE 5.

AGE DISTRIBUTION OF REPEATED VON PIRQUET REACTIONS.

/ "Negative-unchanged" class. The 5 cases were;-

(I) Female non-contact. Neg VP at IO and again at II. Developed P.T. at age of 22 (not included in tables of incidence).

(2) A male non-contact. VP neg;(twice) @ 8 yrs age; gave positive reaction @ IO and was found to have P.T. @ II. Died PT age I5.

(3) A female contact, group A2; VP neg @ 5,7,9 and I2 years of age. Developed Tuberc; Cervical Glds @ age of I4.

(4) A Male contact, group AI; VP neg @ I2 and again @ I3; developed P.T. at the age of I9.

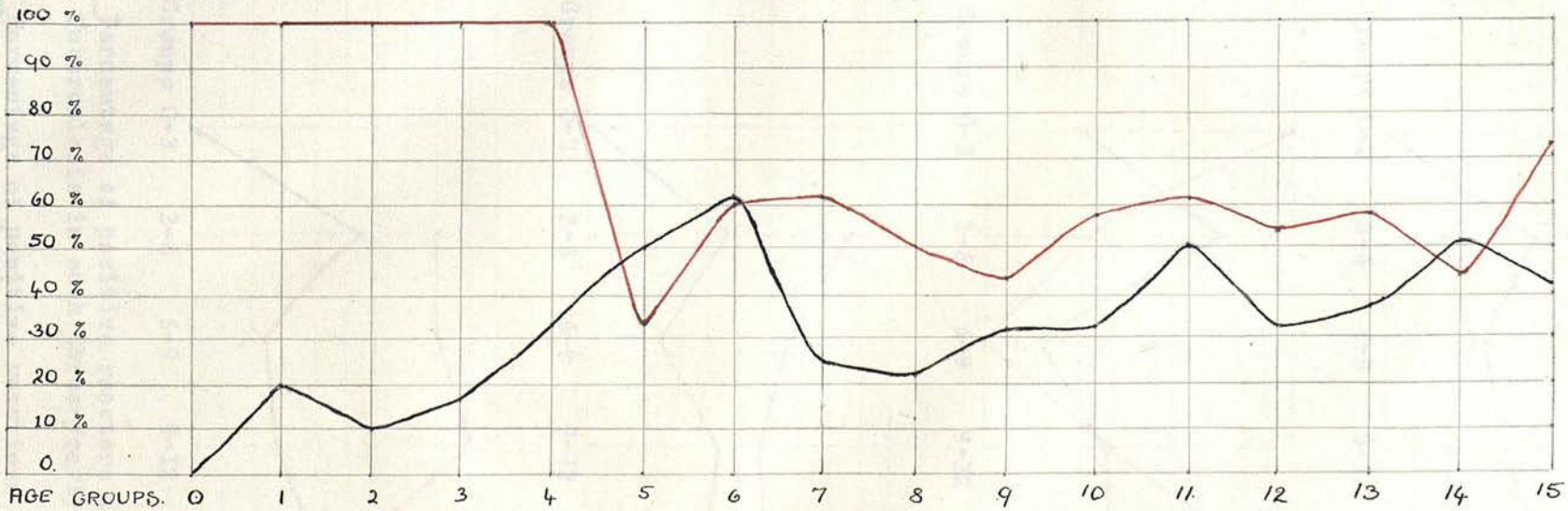
(5) This case requires special mention.
Case number 5378. (Not shown in Table 5). A male. No knowledge of contact up to the age of I5. VP negative at 6 and at I5. Shortly after the latter test his sister was found to have a positive sputum, and a few weeks later the lad developed P.T. (also with positive sputum). His disease is still active.

The first of the above cases had been nursing advanced cases of tuberculosis during the few months preceeding the examination at which she herself was found to have pulmonary tuberculosis.

Another point of interest concerns a contact, case number 5I87 in table 5.

This lad had given a negative reaction when a few months old. At the age of 4 years he gave a positive reaction and on inquiry it was found that his father had had haemoptysis shortly before. The father's sputum contained tubercle bacilli; the boy, however, has remained in good health.

Comments. Positive reactions were rare up to the age of 5. Nine children gave positive results before reaching their tenth years; none of these have shown evidence of disease. On the other hand, five gave positive reactions during adolescence (these were neg when previously tested) and four others (none of them tested within a year of their disease) developed tuberculosis after the age of IO. Thus, five out of the nine known to have been infected during adolescence developed tuberculosis. Up to the age of IO these were presumably uninfected or in a state of anergy. Further comments on this will be made later.

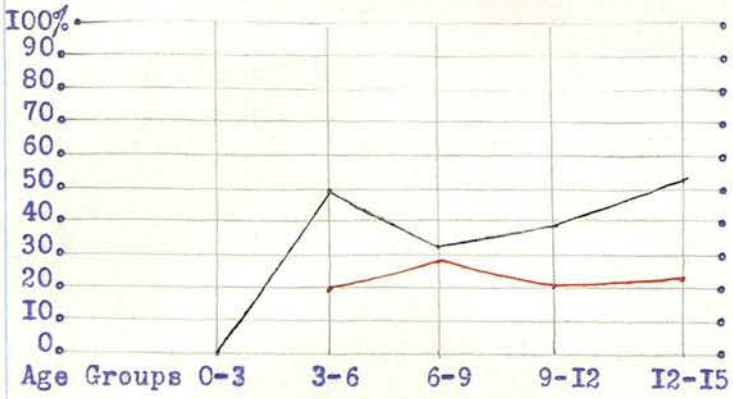


——— = PERCENTAGE OF POSITIVE REACTORS WHICH WERE DIAGNOSED SUFFERING FROM TUBERCULOSIS IN EACH AGE GROUP.

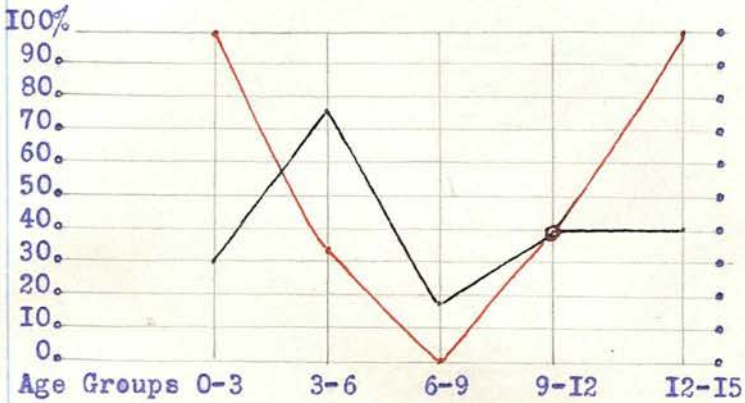
——— = PERCENTAGE OF POSITIVE REACTORS AMONG TOTAL TESTED IN EACH AGE GROUP: EXCLUDING, (a) Those with evident tuberculosis but giving a negative reaction, AND (b) Doubtful reactions.

GRAPH 1.

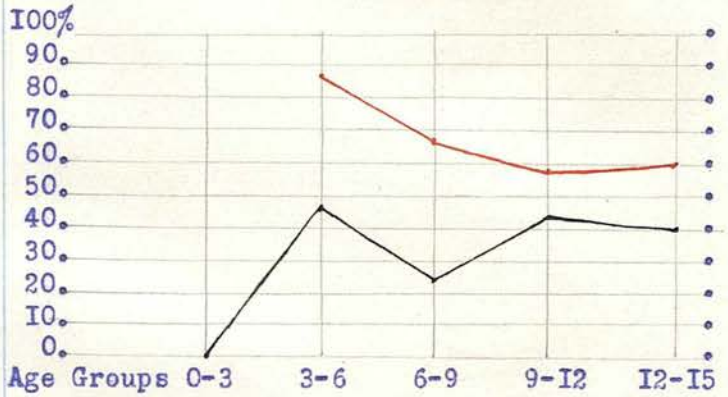
GRAPH ILLUSTRATING RELATIVE INCIDENCE AND "SIGNIFICANCE" OF POSITIVE V.P. REACTIONS IN EACH AGE GROUP — ALL CHILDREN.



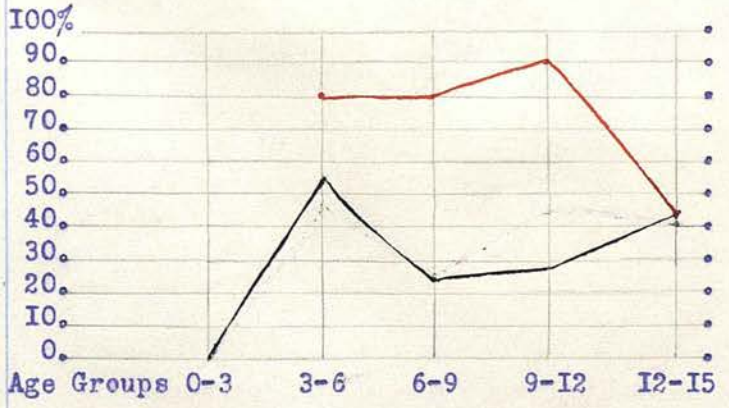
Graph 2.
Male Contacts.



Graph 3.
Female Contacts.



Graph 4.
Female Non-contacts.



Graph 5.
Male Non-contacts.

____ Percentage of positive reactors diagnosed as suffering from Tuberculosis in each three-yearly age group.

____ Percentage of positive reactions in each three-yearly age group, excluding (a) those with tuberculosis but giving neg; VP.
(b) doubtful reactions.

GRAPHS ILLUSTRATING RELATIVE INCIDENCE AND "SIGNIFICANCE" OF POS: VP REACTIONS IN CONTACTS AND NON-CONTACTS. (ANALYSIS OF GRAPH I)

Frequency and Significance of Positive von Pirquet Reactions.

Excluding the doubtful results, I2I out of 343, or 35.28% of the reactions were positive. Of these, 68, or 56.2% were found to be suffering from tuberculosis at the time. For easy consideration of the age distribution and comparison of one group with another, these results have been represented graphic -ally on pages 28 and 29. Owing to a paucity of numbers, the results in each group were collected into three-yearly sub-groups instead of yearly sub-groups. Graph I however, shows the sum of all results arranged in yearly age sub-groups.

"Significance" is here judged from the frequency with which tuberculosis was evident in those who gave positive reactions. (The converse criterion, namely the frequency of positive reactions in those with tuberculosis,is considered in a later section.) On studying the graphs one's attention is drawn to the following;

(I) In Graph I the line of frequency and the line indicating significance both take the form of irregular waves with periods decreasing as age advances. On the whole the significance curve tends to fall as the frquency or incidence curve rises, and vice versa.

(2) In all groups positive reactions become increasingly common up to the 6th year after which the incidence falls rather suddenly, rising again to 40 - 50% during the later years of childhood.

(3) Positive reactions occur with slightly greater frequency in contacts than in non-contacts, more especially during the early years; by the I5th years the frequencies are about equal.

(4) In all groups a high significance is noted during the first 4 years; during the 5th year this curve falls to its lowest point in graph I, but in the analytical graphs this fall is

/this fall is seen to be distributed over several years.

(5) Positive reactions are more significant in non-contacts than in contacts, especially during the middle period of childhood.

A curious feature is observed in grapg 3. Here the significance curve falls to 0 in the period 6-9 years but rises in the succeeding years to 100%.

A more detailed study of the figures reveals the following;- The significance of positive results is greatest in boys at the age of II years after which it falls.

The significance of positive results is least in girls at the age of II after which it rises.

Von Pirquet results in children with evident tuberculosis.

Von Pirquet tests were done on 79 children (under I5 years of age) diagnosed as suffering from tuberculosis at the time. The results were,

Positive in 68 cases.
Negative in 8 cases.
Doubtful in 3 cases.

The doubtful cases have already been dealt with.

The 8 cases giving negative reactions were;-

A female contact (group AI) aged I year, suffering from tuberc; peritonitis. She died within the year.

A male contact (group A3) aged 2 years, suffering from tuberc; peritonitis. Disease since arrested.

A female contact (group A2) aged 3 years, suffering from P.T.SHe died within a year.

A female non-contact aged 3 years, suffering from tuberc; peritonitis. She died within a year.

A female non-contact aged 7, suffering from pleural effusion. Cured.

A female non-contact aged 8, with tuberculous axillary glands. Developed a pleural effusion at age of I6.

A female contact (group AI) aged 8, suffering from P.T.(TB plus sputum). She died within the year.

A male non-contact aged II with tuberculous cervical glands. Disease since arrested.

In only one of the above was the diagnosis confirmed pathologically.

The chief point of interest is the high case mortality in these children; it will be noted that six out of the eight are girls.

Of the 68 positive reactions, 7 were obtained in cases in which the diagnosis received pathological confirmation. (Altogether,8 such cases were tested,so that 7/8 of the type I cases gave pos; reactions.) The remaining 6I were composed as follows;-

6 were male contacts
I5 .. .. non-contacts.
I8 .. female contacts.
2I .. .. non-contacts.

The various diagnoses in these cases were;-

8 cases of pulmonary tuberculosis.
20 .. tuberculosis hilum & mediastinal glands.
5 .. .. hip or spine.
I7 .. .. of the cervical glands.
3 .. of pleurisy.
8 .. .. various kinds.

Six of the above died of tuberculosis, giving a case mortality of approximately I0%. In this connection one should mention that children who were seriously ill when first seen were rarely tested.

Comments: It is reasonable to assume from the above that at least three quarters of children suffering from tuberculosis will give a positive V.P. reaction; it seems fair to regard the prognosis as bad in those with clinical evidence of tuberculosis but giving a negative reaction.

During the first four years of life infection, as indicated by the phenomenon of hypersensitiveness, would appear to be a serious matter. Whether children at this age commonly become infected without the production of this phenomenon, or not, it is difficult to say, but disease at any rate is closely associated with an allergic state; a state of allergy in a child under four does not appear to be compatible with health.During the next two

/next two or three years the position changes. Positive reactions become commoner but less significant. About the seventh year, another and rather sudden change occurs; hypersensitiveness becomes less frequent. It is unlikely that children are less in contact with sources of infection at this age than during the preceeding years,and the writer suggests that about this age, a period of anergy begins to succeed the period of allergy which followed previous infection. About this time positive reactions, when they do occur, tend to have an increasing significance, which is maintained into adolescence [redacted] During the latter half of childhood hypersensitiveness again becomes more common but it never becomes as closely associated with disease as it is during infancy.

It has been pointed out that positive reactions are commoner in contacts than non-contacts but less significant. The suggestion is that casual infection, as it occurs among the general population is more likely to produce disease than the more frequently repeated doses one would expect a contact to receive. However it is possible that contacts take better care of their health than those who have had no experience of the disease.

It is admitted that a good deal of the above is rather speculative, but it does appear to the writer to be suggested by what little data he has been able to collect.

Ultimate fate of those giving (a) negative, (b) positive reactions but in whom no evidence of tuberculosis was found at the time.

This has, to some extent, been dealt with under "Repeated Reactions". The following, negative when last tested, subsequently developed tuberculosis;-

> A male non-contact, negative at the age of a few months, died of tuberculous meningitis aged 8 years.

A male contact, negative at the age of 6 years, developed Tuberc cervic glands at age of IO yrs.

A male contact, negative at the age of 8 years, developed P.T.(TB plus) at I8. Disease active.

A male non-contact, negative at 8, developed P.T. at the age of IO, and died of it.

A female non-contact, negative at II yrs, developed pleural effusion followed by P.T. (TB plus) at the age of I9 years.

A female [redacted] contact, negative at I2, developed tuberc; cervical glands at the age of I3. Active.

A male non-contact, negative at 6, developed P.T. at I5. VP at I5 was again negative. This lad's sputum contains tubercle bacilli at present.

Thus, out of 2I4 children giving negative reactions and with no evidence of disease when tested, 7 subsequently developed tuberculosis, in six cases after a fairly long interval. Incidently, an unfavourable prognosis is attached to six out of the seven.

The following, positive but showing no evidence of disease when last tested, subsequently developed tuberculosis.

A girl contact, VP positive at I4 years, developed P.T. at the age of I5. Disease since arrested.

A girl contact, VP positive at 5, was diagnosed as suffering from tuberculous keratitis at the age of 8 years. Disease since arrested.

Thus out of 53 children giving positive reactions but without any evident tuberculosis at the time, only 2 developed the disease subsequently.

In view of the intervals which elapsed between the tests and the onset of disease it is unsafe to draw any conclusions, but it is interesting to note the unfavourable prognosis in those who, if the von Pirquet test is any indication, became infected during the later years of childhood, or at any rate failed to exhibit hyper-sensitiveness before.

This has a bearing on some comments already made under the heading of "Repeated Reactions". (See page 27)

INCIDENCE OF TUBERCULOSIS.

The histories of 453 children were investigated. Of this number,

68 children with no evidence of tuberculosis when last seen were "Lost trace of" and were therefore discounted from the tables of incidence and death.

IC died from causes other than tuberculosis before attain -ing the 22nd year of age, without ever having shown signs of tuberculosis.

375, the remainder, have been traced to their present ages or to the onset of tuberculosis; (in most cases, those children who developed the disease have been traced to their present ages or to death) 202 were traced through the full period desired, that is to the onset of tuberculosis or to the 22nd year of age. 356 were traced to the onset of tuberculosis or to the I5th year. The incidence of tuberculosis is as follows.

I27 were found to be suffering from tuberculosis at the ages at which they were first examined.

I8 developed tuberculosis subsequently.

7, approximately (actual figure 6.8), is estimated as the proble figure of incidence for the uncompleted years of those who have not yet attained the 22nd year of age.

If one includes the last figure, the total incidence for the 375 children during the first 22 years of their lives is I52.

From the information given in tables I to 4, and by the method described on pages 9 and IO, life tables were constructed to show the incidence of tuberculosis in these children, year by year up to the age of 22. Thes tables for the four main groups are given on the next page.

	AGE GROUPS.	0-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21-22
MALES	INCIDENCE OF TUBERCULOSIS			1·6	1·6	1·6	3·1	4·6	4·6	9	9	12	12	17	17	18	21	21	21	28	28	28	28
	DEATHS FROM "												1·5	3	3	4·5	4·5	4·5	4·5	6	6	6	8
	" " OTHER CAUSES.																3	3	3	3	3	3	4·5
FEMALES	INCIDENCE OF TUBERCULOSIS	1·1	4·6	6	8	10	10	13	13	14	17	18	23	28	34	36	38	38	38	38	38	38	38
	DEATHS FROM "		2·3	2·3	2·3	2·3	2·3	2·3	2·3	2·3	4·5	4·5	4·5	4·5	8	9	10	11	12	12	12	12	12
	" " OTHER CAUSES.											1·1	1·1	1·1	1·1	1·1	2·2	2·2	2·2	2·2	2·2	2·2	2·2

CONTACTS:

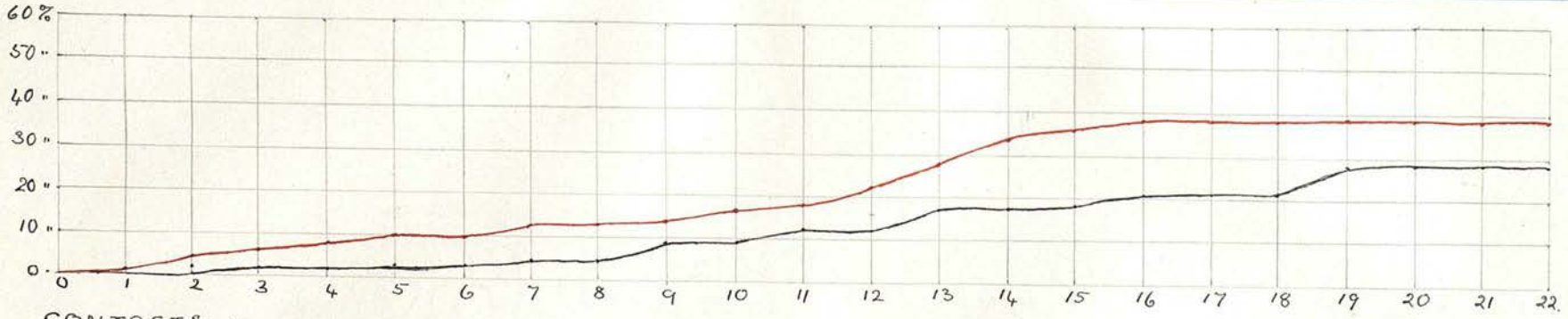
TABLE 6.

	AGE GROUPS.	0-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21-22
MALES	INCIDENCE OF TUBERCULOSIS		1	2	4	5	9	11	12	14	19	23	26	30	32	34	35	36	36	36	36	36	36
	DEATHS FROM "				1	1·8	1·8	1·8	1·8	2·6	2·6	2·6	2·6	3·5	4·3	6	7	9	9	9	9	9	9
	" " OTHER CAUSES														1	1	2	2	2	2	2	2	2
FEMALES	INCIDENCE OF TUBERCULOSIS		1	1	3	4	8	10	15	20	22	25	31	32	38	46	48	48	48	48	50	50	50
	DEATHS FROM "				0·8	0·8	0·8	0·8	1·7	3·3	4·2	4·2	4·5	4·5	9	9	11	12	13	14	14	14	14
	" " OTHER CAUSES									1	1	2	2	2	2	2	2	2	2	3	4	5	5

NON-CONTACTS:

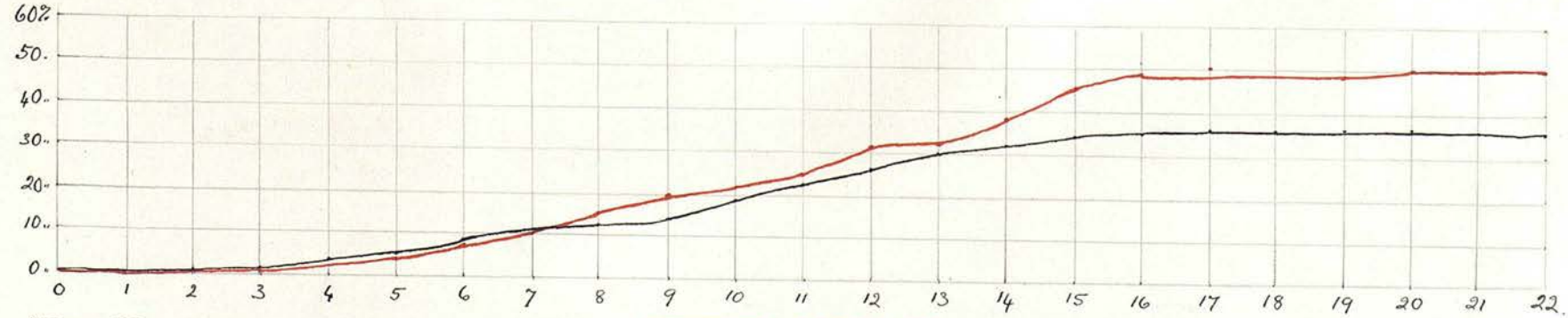
TABLE 7.

TABLES SHOWING RATE OF INCIDENCE OF TUBERCULOSIS AND DEATH RATES CALCULATED IN EACH GROUP PER 100 CHILDREN.



CONTACTS :

GRAPH 6.



NON – CONTACTS:

GRAPH 7.

INCIDENCE OF TUBERCULOSIS — GRAPHIC DEMONSTRATION OF TABLES ON PAGE 36.

Similar tables have been worked ou for the separate groups of contacts, AI, A2 etc;, but the figures are to small to be worth quoting in full. Briefly, the incidence in these groups taken separately may be summarised as follows;-

(As in the other tables the incidence is calculated in each group for I00 children passing through the ages I to 22 years)

	Males AI	A2	A3	Females AI	A2	A3
Incidence at 3 yrs.	0	0	5	I0	9	0
.. .. 6 ..	0	4	5	I4	I5	3
.. .. 9 ..	6	4	20	I9	I8	6
.. ..I2 ..	6	I0	20	29	24	I9
.. ..I5 ..	6	I4	35	38	44	26
.. ..I8 ..	I8	I4	35	46	44	26
.. ..22 ..	46	I4	35	46	44	26

The general inferences suggested by the tables and graphs are;-

(I) That tuberculosis tends to occur more frequently and at an earlier age in girls than in boys.

(2) The incidence rate is steadier in boys than in girls, the latter showing a marked increase, both relative and absolute, during the latter half of childhood.

(3) The cases of disease which occurred after the I5th year occurred mostly in males.

(4) While, as has been previously explained, the contacts and non-contacts cannot be compared for absolute incidence, the latter show a relatively greater increase in the rate of incidence from the 6th to the twelfth years than the former.

(5) Tuberculosis was commoner among AI contacts than among any other children.

Note. The above inferences are, of course, dependent upon a more or less uniform standard of diagnosis. Further information on this may be obtained from the section dealing with the types of disease, and also from a study of the deaths, but in this connection one should mention that almost all the diagnoses were made by the same physician.

Of those cases which were rejected after a few examinations as showing no evidence of tuberculosis, eighteen subsequently developed the disease. These were,

No; 4063. Male contact, Group AI. NAT @ 7. PT (I) @ I5 years

No; 5352. .. .. I2 PT @ I8. Since died.

No; 7402. .. .. I2 PT @ I8. Active.

No; 7397. .. .. .. A2 .. 6, tuberculous cervical glands @ IO. Disease still active.

No; 4062 Female contact, Group AI, NAT @ 4, PT @ 8. Died.

No; 47II .. .. I4, PT @ I5. Arrested.

No; 48I5 .. .. .. A2 .. 5, Tuber; Keratitis at 8 years of age. Disease arrested.

No; 4628 Female contact, Group A2, NAT @ 5, Tuberc; cervical glands at I3 years of age. Disease still active.

No; 4607 Female contact, group A3, NAT @ IO, tuberc; elbow at II. Died of meningitis at age of I3 years.

No; 407I Female contact, group A3, NAT @ 2, Tuberc; ankle at I2. Disease still active.

No; 536I Male non-contact, NAT @ O-I, Died Meningitis @ 8yrs

No; 5207 .. .. 8. developed PT @ IO yrs.

No; 5378 .. .. 6 .. PT I5 ..

No; 6209 .. .. I4 died Meningitis @ I6.

No; 7575 Female non-contact, NAT @ 6, P.T. @ 8 . Died @ 9yrs.

No; 3976 .. .. 6, developed tuberc; mediastinal glands at 9 yrs. Disease arrested.

No; 4706 Female non-contact, NAT @ 8, PT @ I5. Now Quiescent.

No; 4798 .. .. II, developed a pleural effusion @ I9 years. Found to have pulmonary tuberculosis with positive sputum at 22 years age.

IO of the I8 were contacts, 5 of these from group AI. This number represents 9.5% of those contacts primarily rejected as NAT. If to this figure be added the estimated incidence for the uncompleted years of those who have not yet reached the 22nd year of age, the percentage rises to I3.8. The average interval

/interval between the time when they were first examined and the age at which tuberculosis first became evident was 5.I years, which period rather precludes the question of error in diagnosis. The average age at which tuberculosis first became evident (in these cases) was, in contacts, I2.8 years of age.

In non-contacts the corresponding incidences of disease subsequent to the cases having been removed from the register as non-tuberculous, were 6% and 7.8% with the same average interval as occurred in contacts. Thus this "Subsequent incidence" is higher in contacts but in both contacts and non-contacts it is apparently associated with the onset of adolescence.

Comments. Among the children examined in the dispensary it seems clear that girls show a higher incidence of tuberculosis than boys, especially during the second half of childhood. It is possible that, where the disease is suspected, girls are more easily persuaded to attend than boys and that they are more willing to assist the physician in his diagnosis. However this may be, it seems unreasonable to assume that they become infected any more frequently than boys and the writer is inclined to the belief that, during the latter half of childhood and possibly associated with the onset of puberty, girls do not stand infection (or re-infection?) as well as boys. This is to some extent supported by the later rise in incidence which occurs in boys, a rise by which, towards the end of puberty, the incidences for both sexes are again brought into close approximation.

Contacts apparently develop tuberculosis during adolescence more commonly than non-contacts; in this connection one case deserves special mention.

> Case No; 4063. First examined at the age of 7 - NAT. Three sisters died of tuberculosis when he was aged 8, IO & I4 respectively. At I6 he was suspected to have the disease. Three years later his mother died of tuberculosis and he himself was found to have a positive sputum.

Surely, this lad must have been infected repeatedly from his 8th year onwards; yet no evident disease was observed until he reached his I6th year, which again supports the association between the onset of disease and the onset of puberty. It would seem that, after the fourth year of life, infection,or perhaps repeated infections, produce some degree of immunity, which however breaks down with the onset of puberty.

It will be noticed that nearly half of the those diagnosed as suffering from tuberculosis were "Known contacts". Now the number of cases on the tuberculosis register for the area in which this work was done averages about I350 (at the present moment it is I34I). The total population in the area is about 240,000 persons out of which I3000 would be a generous estimate of the known contacts. It seems obvious that tuberculosis is much commoner among contacts than among non-contacts, unless nearly half the population are contacts; if the latter be true it is a singular thing that an examination of such a limited number of them should have revealed such a high proportion of cases of tuberculosis or that tuberculosis is not notified in numbers many hundreds of times greater than it is. Unfortunately the age and sex incidence of the population is not available, but it seems very unlikely that the application of any rule for the estimation of "Probable errer" is likely to affect the significance of the above figures. In any case, one is of the opinion that there is here a strong argument for the diligent examination and re-examination of known contacts.

A summary of the types of lesions diagnosed.

The following were the varieties of disease in those diagnosed as suffering from tuberculosis, together with the average ages of those in whom the diagnoses were made.

Lesion.	Contacts		Non-contacts		Totals
	Males	Females	Males	Females	
Pulmonary Tuberculosis, number;	3	I2	8	II	34
.. .. average age;	I2	II½	I2½	II	I2
Hilum & Mediastinal glds. no;	8	9	I	6	24
.. .. average age;	8	9	I0	5	8
Pleurisy. number.	4	3	-	-	7
.. average age	I0	II	-	-	I0½
Bones and Joints, number.	9	I0	3	5	27
.. .. average age;	6	7	7	7	7
Tuberculous peritonitis. no;	-	4	2	I	7
.. .. average age;	-	6½	7	I	6
Cervical glands. number,	I4	I6	I	8	39
.. .. average age	9	II	I0	I0	I0
Various other forms; number,	3	3	-	I	7
.. .. average age	II	9	-	8	I0
Total numbers, all forms.	4I	57	I5	32	I45.
Average Ages.	8½	I0	I0	8½	

Little of importance can be deduced from this table. The higher incidence of disease in girls as compared with boys seems to be maintained generally throughout the various lesions. The order of incidence in respect of age is more or less constant for all four groups. It is as follows;

(I)Peritonitis occurs earliest, average age being under 6 yrs.

(2)Bones and joints next .. .. .. 6 to 7 ..

(3)Hilum and mediastinal glds .. .. .. 7 to I0 ..

(4)Cervical Glands .. .. .. 9 to II ..

(5)Pulmonary tuberculosis .. .. .. over II ..

Note. An exception occurs in the case of female contacts, in whom (2) and (3) are reversed in order.

Tuberculosis of the hilum and mediastinal glands and cervical glands was diagnosed more commonly in non-contacts than in contacts. This also applies to tuberculosis of bones and joints. Thus, between the ages of 7 and II occur the less serious types, again suggesting some relative immunity at this period.

FATE OF THE DIAGNOSED CASES.

Pulmonary Tuberculosis. The fate of the 34 children who were diagnosed as suffering from pulmonary tuberculosis was as follows.

Male contacts. 2 died; average duration of disease under I year.
4, disease cured.
2 disease stationary.
Female contacts. 8 died; average duration of disease I-2 years.
I, disease cured.
I, disease arrested.
I, disease stationary.
Male non-contacts. 2 died, average duration of disease 3½ years.
I, disease stationary.
Female non-contacts. IO died; aver; duration of disease under I yr.
I disease arrested.
I lost trace of.

All the type I cases died. The case mortality was higher in non-contacts than in contacts. The effect of treatment is shown by the following.

	Males	Females.
(a) Case mortality of those treated in institutions	50%	
(b) ".. .. .. by Gen; supervis;		69%
(c) .. .. not treated by the T.O.	50%	IOO%
Average duration of disease of those dyng in (a)	5 yrs.	
.. .. (b)		2¼ yrs.
.. .. (c)	I½ ..	Under I ..

This illustrates the advantage of institutional treatment.

Pleurisy. 7 cases diagnosed, 5 of them with effudion.

Male non-contacts. Both cases of dry pleurisy cured.
I lost trace of. I, Arrested.
Female non-contacts. 2, disease cured.
I, developed P.T. (TB positive sputum)

None of these received institutional treatment.

Hilum and Mediastinal Glands. The fate of the 24 children who were diagnosed as suffering from these varieties was as follows.

Male contacts. I, disease cured.
Female contacts. I, disease cured.
2, disease quiescent.
2, developed P.T. (now quiescent.
I, Lost trace of.
Male non-contacts. 3, disease cured.
3, disease arrested.
2. Lost trace of.

Female non-contacts. 3, disease cured.
2, disease arrested.
2, lost trace of.
2, developed P.T. in adolescence. One of these has active disease, the other is quiescent.

Only one of the above, a girl contact, received institutional treatment. One notes that the prognosis appears poorer in girls than in boys.

Tuberculosis of bones and joints.

Male contacts. I, disease cured.
I, disease quiescent.
I, died of tuberculous meningitis.
Female contacts. I died (tuberculosis)
I died causes other than tuberculosis.
2, disease cured.
I, disease stationary.
Male non-contacts, 5 died of tuberculosis.
I died of causes other than tuberculosis.
I, disease arrested.
I, disease quiescent.
I, lost trace of.
Female non-contacts. I died of tuberculosis.
I died of causes other than tuberculosis.
4, disease cured.
3, disease quiescent.
I, disease still active.

The effect of treatment is shown by the following (those dying from causes other than tuberculosis excluded.)

		Males	Females.
(a)	Case mortality of those treated in institutions	43%	10%
(b)	.. .. by gen; supervis;	50%	25%
(c)	.. .. .. not treated by T.O.	66%	

Average duration of disease in those dying in (a) 2 yrs 3 yrs.
.. .. (b) 9 .. 2 ..
.. .. (c) I½ .

The lower case mortality in those treated in institutions is well demonstrated.

Tuberculous peritonitis.

Male contacts. I, died; duration of disease under I year.
I, disease arrested.
Female contacts. I died, duration of disease under I year.
Female non-contacts. 3 died, average duration of disease Iyear.
I, disease quiescent.

Only 2 of above received institutional treatment. I of these died.

Tuberculosis of the cervical glands. The fate of the 39 children diagnosed as suffering from tuberculosis of the cervical glands was as follows.

Male contacts. I, disease quiescent.
Female contacts. I died tuberculous meningitis within a year.
I died of causes other than tuberculosis.
3, disease cured.
I, disease arrested.
2, disease still active.
Male non-contacts. 9 (including 2 of type I) cured.
4, disease arrested.
I developed Pulmonary tuberculosis at age of I2
Female non-contacts 2 died, one of P.T.(I) & I of tuberc meningitis
5 cured (including 2 of type I)
I disease arrested.
I disease quiescent.
I developed pleurisy, now quiescent.
2 disease stationary.
4 lost trace of.

Altogether 3 died of tuberculosis; 2 others developed other forms of the disease wlile in yet another 4 the disease is still active. 5 males received hospital treatment and all of these have done well. IO males were treated by "General supervision" and 9 of these did well. I9 females were treated by "General supervision" but only II of these have made satisfactory progress. Again one notes the less favourable prognosis in girls. and again is demonstrated the advantage of hospital treatment (the five cases treated in hospital were all type I.)

Various Lesions.

Female contacts. I, Tuberc; keratitis. Treated G.S. Arrested.
Male non-contacts. I, tuberc ulcer of leg. Hospital. Cured.
2, meningitis; died within few weeks.

Female non-contacts. I, Lupus. Treated G.S. Disease still active.
I, Tuberc axil; glds. Pleural effus; age I6.
I, tuberc ulcer cheek. Died PT (I) age I7.

Concerning these there is little to note save that six out of the seven were non-contacts.

Comments. The prognosis for those diagnosed as suffering from tuberc; hilum and mediastinal glands is fairly good, but in cases of disease of cervical glands the outlook is less favourable.

In most types boys respomd to treatment better than girls. Institutional treatment gives the best results and those who attend the dispensary do better than those who do not.

A CONSIDERATION OF THE DEATHS

Of those with no evidence of tuberculosis, ten (six boys and four girls) died before reaching the 22nd year. The average age at death was I6 years.

Of those who had shown evidence of tuberculosis, four died from causes other than tuberculosis. These were;-

A male non-contact died aged 22 yrs; cause of death "Banti's dis".
A female .. .. IO .. .. "Epilepsy".
A .. contact .. .. IO .. .. "Diphtheria"
A .. .. I5 .. .. "Pneumonia".

Up to the present, forty deaths have occurred from tubercul -osis.

Case Mortalities. The case mortalities for the principal varieties are as follows;-

	Contacts;		Non-contacts		All Cases.
	Males	Females	Males	Females	
Pulmonary tuberculosis.	37%	72%	66%	75%	62.5%
Tuberculosis of spine.			50.	50.	
.. .. hip.	I00.	6	66.		
Tuberculous peritonitis.	50.			75.	
.. cervical glds		I2½.		I2½.	
Case mortality for groups	33	3I.	22.	28.	
Average age at death	I5	II	II	I2½	

The case mortality is higher in contacts than in non-contacts.

Death Rates. Tables 6 and 7 show the rates of death calculated for I00 children in each group. Briefly, the rates per I00 were;-

	By the age of 5, 0;	by IO, 0;	by I5, 4.5;	by 22, 8.
Male contacts;				
Female	2.3 ..	4,5 ..	IO ..	I2.
Male non-contacts	I.8 ..	2.6 ..	7 ..	9
Female	0.8 ..	4.2 ..	II ..	I4.

Note; It should be remembered that these figures apply to I00 children passing through the ages 0 to 22, not to I00 at each age.

SUMMARY OF CONCLUSIONS

The main objects of this investigation have been described on pages 4 and 5. They were grouped under two headings;

A. Points of practical importance to the Tuberculosis Dispensary worker, and

B. Objects concerning the Aetiology of Tuberculosis.

It will be well to sum up the results of the work under the same headings. It should be remembered that the statements which follow apply only to persons up to 22 years of age.

A. Points of practical importance to the Dispensary worker.

It was desired to obtain some information on the value of the von Pirquet reaction; to trace the course of disease, especially the more benign types, in those children found to be suffering from tuberculosis, and to evaluate the effect of treatment afforded by such a scheme as that to which the writer is attached; finally, to obtain some information on the life histories, subsequent to examination, of those who, at the time of examination, are written off the register as "Non-tuberculous", particularly to ascertain the incidence of tuberculosis, subsequent to examination, among contacts, with a view to deciding if periodical re-examination of all known contacts would be a profitable proceedure.

Von Pirquet Reactions. Both the frequency and significance of positive reactions vary with age. They are commoner in contacts than in non-contacts but rather less frequently associated with disease in the former than in the latter.

At least 75% of those suffering from tuberculosis will give a positive reaction. It is fair to regard the prognosis as bad in those with clinical evidence of tuberculosis but who give a negative reaction.

During the first four years of life a positive reaction is a strong indication of the presence of active disease. From four to seven positive reactions become commoner but less significant. At about the seventh year there is a sudden fall in frequency, but both frequency and significance rise again slowly as puberty approaches, the results becoming more significant at a slightly earlier age in girls than in boys. About the fifteenth year, some 50% of those giving positive reactions show evidence of disease.

Incidence of Tuberculosis. Tuberculosis occurs more commonly in contacts than in the general population. If that portion of the latter which attends a tuberculosis dispensary be taken as an indication, it is commoner in females than in males. The adolescent type occurs at an earlier age in females than in males. The more benign types of tuberculosis, such as disease of the hilum, of the mediastinal and cervical glands appear to be commoner in non-contacts than in contacts.

The prognosis for those diagnosed as suffering from disease of the hilum and mediastinal glands appears good, but of course the possibility of error in diagnosis in these cases is probably greater than in any other type of lesion. In cases of disease of the cervical glands the outlook is much less favourable.

The best results are obtained by institutional treatment. Those who attend the dispensary do better than those who do not.

Re-examination of contacts. Approximately 10% of those contacts who were written off the register as non-tuberculous subsequently developed tuberculosis (some of the others have not yet reached adolescence; including an estimated figure for these the percentage reaches 14). The average interval elapsing was 5 years. This is ample justification for the re-examination of all known contacts.

B. Objects concerning the Aetiology of Tuberculosis.

On page 3 are recorded some of the problems in the aetiology of tuberculosis on which it was hoped some light might be shed. These problems included such items as,

The relation between re-infection and immunity.

The normal duration of allergy. The effect of re-infection during a period of (a) allergy (b) anergy,etc;

The effect of puberty on these states and the consequence of infection when they are so modified.

It would indeed be rash to suggest that conclusive explanations of such problems can be made from the little information which has been obtained but the writer thinks that, on the evidence collected, the following comments are justifiable.

Speaking graphically, the line of frequency of hypersensitive-ness takes the form of a wave with a period which increases as age advances. Its maximum height is reached about the sixth year after which it falls suddenly. It is unlikely that children are less in contact with sources of infection during the seventh and eighth years than during the fifth and sixth and the writer suggests that about this age a period of anergy begins to succeed the period of allergy which followed previous infection.

Towards puberty hypersensitiveness again begins to become a more common phenomenon. It is interesting to note that the more benign types of disease tend to occur in the middle period of childhood, that is about the period of suggested anergy; while more serious varieties occur in the early years and again towards puberty, that is,to again make a graphic reference, on the rising segment of the allergic wave.

Infection during the first four years is a serious matter.

After the 4th year, infection seems to produce some degree of immunity, which, however, breaks down towards puberty. There is some suggestion that the immunity produced by repeated infection lasts somewhat longer than that obtained by casual infection. There is also some suggestion that those who are not infected during the first half of childhood are more likely to infection with production of evident disease during the later years than those who have been previously infected.

It has been said that statistics will prove anything -even the truth. Statistical investigations are not the most satisfact -ory methods of obtaining information, but for such work as this it is difficult to obtain information in any other way. Clinicians are not always willing to accept the results of epidemiologists; what may be true of communities is not necessarily true for individuals, and clinicians are concerned with individuals. Hence the need for co-orporation between the clinician and the epidem -iologist. The next task is to see if clinical corroboration will be obtained for the suggestions made above. One trusts that statistics do prove something - "Even the truth!"

Since the commencement of this investigation, the writer has been on the look out for any corroboration obtained from other work on the same subject. Some interesting information occurs in the Framingham report and in the Hälsan report but these are already too well known to justify inclusion here. However, two statements occurring in a recent preliminary report on "The fate of young children in tuberculous households" (Dr Lissant Cox) are worth quoting. they are;- "The deaths from non-pulmonary tubercul -osis were much greater in contacts than in the control (the

/the general population); and "It is remarkable that female babies succumbed at nearly twice the rate of the male babies".

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